

THE SECOND INTERNATIONAL SYMPOSIUM ON SPACE CLIMATE

“Long-Term Changes in the Sun and their Effects in the Heliosphere and Planet Earth”

Sinaia, Romania, 13–16 September 2006

FINAL REPORT ON EOARD PROJECT ENTITLED “The Second International Symposium on Space Climate” (AWARD NO.: FA8655-06-1-5069)

The symposium topic belongs to a modern scientific field, which is based on the multidisciplinary scientific research in the fields of solar physics, heliospheric physics, magnetosphere and terrestrial atmosphere. The concept of **space weather** was launched about a decade ago in order to describe the short-term solar variations (days, weeks) and their effects in the near-terrestrial space (magnetosphere, atmosphere, biological systems, technological systems). Analogous to the relationship meteorology–climate at the terrestrial level, the concept of **space weather** extended to that of **space climate**, at the beginning of the first decade of the 21st century, in order to include long-term solar variations (of over several months – to several dozens years) as well as their long-term effects in the heliosphere, magnetosphere, terrestrial climate and many other systems. The scientific research in this multi- and inter-disciplinary field approaches problems of major interest for terrestrial life such as the global warming phenomenon. The clarification of the possible causes of solar and/or heliospheric origin which might be at the origin of the multiple climate anomalies of the last decade will have a strong impact on the world economy, therefore on the national one too.

The Second International Symposium of Space Climate continues the series of symposia dedicated to this topic, which began with the First Symposium organized in Oulu (Finland) in June 2004. The initiative committee of these symposia (K. Mursula and I. Usoskin – Finland, E. Cliver – USA și J.-P. Rozelot – France) proposed the organization of the next symposium in Romania. The Astronomical Institute of the Romanian Academy accepted to be the main organizer and later, the Institute for Space Sciences, Bucharest–Măgurele also supported the organisation of this symposium. Detailed information about the Symposium– its science objectives, program, list of attendees, the abstract booklet, information about accommodation and Romania can be found at: www.issc2.ro.

The symposium took place in Sinaia, the Pearl of the Romanian Carpathian Mountains, at Sinaia hotel. The proceedings were structured on three major topics from the research fields involving:

- A. Sun and Solar Activity
- B. Heliosphere and Cosmic Rays
- C. Terrestrial Effects

34 invited papers were presented (15 related to the subject A; 7 related to the subject B; 12 related to the subject C), 15 oral contributions (five – subject A; four – subject B; six – subject C) și 35 posters (16 – subject A; three – subject B; 16 – subject C), structured on ten sessions. The last session, the 11th one, was dedicated to one hour debates on two

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14. ABSTRACT The Final Proceedings for The Second International Symposium on Space Climate, 13 September 2006 - 16 September 2006 Long-term changes in the Sun, its effects on the heliosphere and upon the Earth. The Symposium will be organized in four main sections: Section 1. Solar physics topics Section 2. Heliosphere and cosmic rays Section 3. Terrestrial effects Section 4. Prediction principles and methods of future solar activity					
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topics of major scientific interest:

- 1 What Happened to the Sun during the Last 100 Years?
- 2 How Does the Sun Affect Climate and what Evidence We Have for that?

A review of the Symposium papers was presented in the same session.

The posters were exhibited throughout the entire duration of the symposium and there was an interval of an hour and a half dedicated especially to the posters in the fourth session (on 13 September).

Some important aims of the Space Climate were presented and debated during Symposium.

One of the main aims of Space Climate is to better understand the long-term solar variability and, in particular, the observed extremes and possible repeatable patterns of this variability. Several ISSC2 contributions discussed this topic and presented interesting new results, e.g., on early sunspot activity, on systematic patterns in solar and heliospheric magnetic fields and their hemispheric and longitudinal asymmetries.

Another important aim of Space Climate is to better understand the complicated relationships between the Sun, the heliosphere and the various proxies of long-term solar activity, e.g., geomagnetic activity, cosmic rays and cosmogenic isotopes. It is interesting to note that quite different results were presented, e.g., on how the solar wind and the heliospheric magnetic field have changed only during the last 100 years. Both based on geomagnetic indices but using different methods, it has been proposed, on one hand, that the heliospheric magnetic field has more than doubled its strength and, on the other hand, that it has remained rather constant during the last century. Clearly, this indicates that the long-term relationships between solar, heliospheric and solar-terrestrial parameters are not yet satisfactorily understood. A number of contributions discussed the methods and recent results obtained from various proxies of solar activity, e.g., different cosmogenic isotopes and geomagnetic activity.

A third important aim of Space Climate is to better understand the long-term effect of the changing Sun on the near-Earth environment, in particular on the different atmospheric layers and on global climate. Although this wide research area was not fully covered in the papers presented, there were several papers that presented interesting new ideas and observations demonstrating that long-term solar variability is an essential factor in the observed variability of global and local climate and its various elements (cloud patterns, ocean streams, winds, etc.).

The papers presented and discussed during the Symposium demonstrated that Space Climate is a vibrant, versatile and important branch of space science situated at the very core of solar-terrestrial physics. There still are a number of important open questions about the solar magnetism, the long-term behavior of solar activity, the implied changes in the heliosphere and, in particular, the long-term effects at the Earth.

ISSC2 included three days of presentations and discussions, and one day devoted to a trip to Sinaia and Bran. The participants visited the Sinaia Monastery and Peles Castel (in Sinaia) as well as the Dracula Castel (in Bran).

The bulk of the proceedings of this symposium was one specific to its complex topics, multi and inter-disciplinary. The invited papers were in a greater number than at

other meetings of a similar scope in order to introduce a new scientific field, to define and set up the field of interest of new concepts, as well as the specific research methods. It is worth mentioning that seven invited lecturers were young PhD scientist, under 35 years old, who have distinguished themselves through their previous results, of a high scientific level.

Out of the total of 58 foreign specialists, 16 were young doctors or phd candidates and all of them presented papers. Renowned specialists from the fields of solar physics, heliosphere, magnetosphere and terrestrial climatology also presented invited papers. It is worth mentioning that among them there were directors of research intitutes (from Germany, Switzerland and Azerbaijan), and professors from USA universities (the Universities of Texas, California, Montana, Michigan, New Jersey), from Finland (the University of Oulu), Russia (Lomonosov University, Moscow).

Romania was represented by 17 specialists from three institutes (the Astronomical Institute of the Romanian Academy, the Geodynamics Institute of the Romanian Academy and the Institute for Space Sciences – Bucharest, Măgurele), as well as two universities (Bucharest University – the Faculty of Physics and the University „Dunărea de Jos”, Galați). From among them, six were young researchers under 35 years. The participants of these three institutes presented three invited papers, two oral contributions and nine posters. It is also worth mentioning that there were two contributions made in the collaboration by researchers of different institutes: AIRA and the Institute of Geodynamics, AIRA and ISS, respectively.

A great number of invited and contributed papers presented during ISSC-2 were considered for publication in a special issue of the Advances in Space Research Journal, a recognized peer-review journal dedicated to space research. The special issue will be fully dedicated to Space Climate. The issue includes also two extra-papers which were not presented in ISSC2. All submitted papers were subjected to a normal peer-review by two reviewers. The volume is edited by three guest editors (K. Mursula, I. Usoskin and G. Maris) and supervised by the Editor-in-chief M. Shea. There also are some papers accepted for publication in the same Journal but in the regular issue. All the paper accepted could be found at:

http://www.sciencedirect.com/science?_ob=PublicationURL&_cdi=5738&_auth=y&_acct=C000049135&_version=1&_urlVersion=0&_userid=950183&_pubType=J&md5=22326d35f57d57226847e02ebd8e0aa5).

The gathering of researchers from various countries in international meetings are occasions for interesting debates, exchanging ideas and the sketching of future projects. The Symposium in Sinaia made also possible the meeting of the national representatives from most of the countries which participate in the Regional Collaboration „Balkan, Black Sea and Caspian Sea Regional Network on Space Weather Studies”. On that occasion, at an ad-hoc round table (14 September) important problems concerning the journal „Sun and Geosphere” and the organization of a regional meeting in Baku (Azerbaijan), in September 2007 were discussed.

The Romanian participants from various institutes of apparently different profiles (astronomy, space research, geodynamics) had one more proof about the importance of collaboration for the opening of new directions of modern research, which are also beneficial to the Romanian scientific research. Thus, the unification of the research

efforts in order to explain and to quantitatively evaluate the energy and mass transfer of the solar wind in the magnetosphere-terrestrial atmosphere system will offer a scientific basis for the improvement of both the geomagnetic prognoses and of the climatic ones. The symposium gave the Romanian researchers the opportunity to present the newest original results in a meeting with world top specialists. Still unpublished results were submitted to the analysis and the debates with the other participants.

ISSC2 would not have been possible without the support from the European Office of Aerospace Research and Development, (EOARD, www.london.af.mil). With funds received from this agency, the Organizing Committee was able to provide partial support (symposium fee and/or accomodation) to 23 ISSC2 participants, of which a large fraction were young postdoctoral researchers.

Locally, we received support in the organization of ISSC2 from the National Authority for Scientific Research Ministry for Education and Research of Romania, (http://www.mct.ro/ancs_web/index.php).

The organisation of the symposium in Sinaia, hotel reservations, the transfer of the participants to Sinaia and back, conference rooms and the trip were provided by our collaborators, the turism agency Atlantic Tour. We thank them for the fruitfull contribution.

The organization in Romania of this Symposoium on the eve of our European integration was a serious challenge. Although the Symposium had a great number of participants and a restricted budget of expenses, the opportunity was fully capitalized, becoming also a proof for the international scientific community that Romanian can integrate in the circuit of important meetings organizers.